

**REMARKS**

As an initial matter, Applicants thank the Examiner's indication that Claim 7 would be allowable if rewritten to overcome the rejections under U.S.C. 112, second paragraph and include all of the limitations of the base claim and any intervening claims.

The three paragraphs added to the Background section with the Amendment filed May 22, 2006 have been deleted without prejudice.

Claims 4 and 7 have been amended to recite the inventions with greater clarity. In particular, Claims 4 and 7 have been amended to clarify the limitation that the nanotube mesh partially fills the cross-section of the channel segment so as to define a gap therethrough. No claims have been deleted and no new claims added. Applicants have previously elected Claims 1-19 and 45-46 for prosecution, and Claims 20-44 have been withdrawn. No new matter has been introduced by this amendment to the Claims.

**Specification Objection under 35 U.S.C. § 132(a)**

The amendments to the Specification filed May 22, 2006 have been objected to under 35 U.S.C. § 132(a) as they allegedly introduced new matter. Applicants traverse the objection.

Applicants have deleted the paragraphs added with the May 22, 2006 Amendment. Therefore, the objection under 35 U.S.C. § 132(a) become moot and reconsideration is respectfully requested.

**Claim Rejections under 35 U.S.C. § 112**

Claims 1, 3-15, 17-19, 45 and 46 have been rejected under 35 U.S.C. § 112, first paragraph as allegedly failing to comply with the written description requirement. Applicants traverse the rejection.

The Examiner maintained the rejection of Claims 1, 3-15, 17-19, 45 and 46 for allegedly failing to comply with the written description requirement of 35 U.S.C. § 112,

first paragraph. In particular, the Office alleged that the terms “elastically compressed” and “elastically compress” are not supported in the specification as originally filed.

Applicants respectfully traverse. It is well established that to satisfy written description requirement, “it is not necessary that the application describe the claim limitation exactly,...but only so clearly that persons of ordinary skill in the art will recognize from the disclosure that appellants invented processes including those limitations.” *Forssmann v. Matsuo*, 23 USPQ 1548, 1550 (B.P.A.I. 1992). “The test for sufficiency of support in a parent application is whether the disclosure of the parent application relied upon reasonably conveys to the artisan that the inventor had possession at that time of later claimed subject matter.” *Ralston Purina Co. v. Far-Mar-Co, Inc.*, 772 F.2d 1570, 1575, 227 USPQ 177, 179 (Fed. Cir. 1985). Thus, written description requirement under the first paragraph of 35 U.S.C. 112 does not require literal support for the claimed invention. Rather, it is sufficient if the originally-filed disclosure would have conveyed to one of ordinary skill in the art that the inventor had possession of the concept of what is claimed. *Ex parte Parks*, 30 USPQ2d 1234 (B.P.A.I. 1994).

Accordingly, literal support for the limitation of “elastically compressed” and “elastically compress” recited in the instant claims is not required, so long as the original disclosure would have conveyed to one of ordinary skill in the art that Applicants had possession of the concept of “elastically compressed” or “elastically compress” at the time of the present application. The original disclosure of the present application has done so. As clearly illustrated in FIG. 1C, the nanotube mesh can be grown a bit higher than the channel wall size. A cover 15 can be used to pack the outgrowth of the mesh from the channel, as illustrated in FIG. 1D. In this manner, a good contact may be formed without producing a gap between the mesh and the cover. See also the Specification in paragraph 0031. This original disclosure has conveyed to one of ordinary skill that the nanotube mesh is elastically compressed by the cover. A “good contact without a gap between the mesh and the cover” cannot be achieved if, for example, the mesh is rigidly broken when it is compressed or packed by the cover.

Further, in connection with the description of FIG. 1C, the Specification states that carbon nanotube elements possess unique mechanical strength and elasticity which makes the mesh highly robust. See paragraph 0028.

Both the drawings and the Specification have conveyed to one of ordinary skill that Applicants had possession of the claimed invention with the limitation of "elastic compression" or "elastically compressed" at the time of the present application.

Applicants also direct the Office's attention to *In re Wright*, 9 USPQ 2d 1649, 1651 (Fed. Cir. 1989). The issue before the Federal Circuit was whether the term "not permanently affixed thereto" used to describe microcapsules on the surface of a support was supported by the specification as filed. In reaching the decision that the specification did indeed support the claim language without literal support in the specification, the Federal Circuit noted that method used to manufacture the device produced microcapsules not permanently affixed to the support as claimed.

Similar to the facts of *Wright, supra*, Applicants' specification in paragraph [0028] clearly notes that the carbon nanotubes prepared by the process "possess unique mechanical strength and elasticity which makes the mesh highly robust". (Emphasis added). Thus, stated another way, the nanotubes are elastically compressed on the mesh as stated in the amended claims.

Reconsideration of the rejection of Claims 1, 3-15, 17-19, 45 and 46 under 35 U.S.C. § 112, first paragraph is therefore respectfully requested.

Claims 4 and 7 were rejected under 35 U.S.C. 112, second paragraph for allegedly failing to particularly point out and distinctly claim the subject matter of the invention. The claims have been amended as noted above in a sincere effort to remove the grounds for rejection.

In view of the preceding amendments and remarks, reconsideration and withdrawal of the rejections under 35 U.S.C. § 112, first and second paragraphs, is respectfully requested.

**Claim Rejections under 35 U.S.C. § 103(a)**

Claims 1, 3-15, 17-19, 45 and 46 have been rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over U.S. Patent Application No 2004/0149209 ("Dai *et al.*") in view of U.S. Patent No. 6,685,810 ("Noca *et al.*"). Applicants traverse the rejection.

It is well established that to establish a proper *prima facie* case of obviousness, three criteria must be met. First, there must be some suggestion or motivation, either in the cited references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify or combine the cited reference relied upon by the Examiner to arrive at the claimed invention. Second, there must be a reasonable expectation that the suggested modification or combination would be successful. Finally, the prior art reference (or references when combined) must teach or suggest each and every limitation of the rejected claims. The teaching or suggestion to make the claimed modification or combination and the reasonable expectation of success must both be found in the prior art, and not based upon in the applicant's disclosure. M.P.E.P. §706.02. Applicants respectfully submit that a *prima facie* obviousness has not been established and the inventions recited in instant Claims 1, 3-15, 17-19, 45 and 46 are patentable over Dai *et al.* in view of Noca *et al.*.

Dai *et al.* generally teach that carbon nanotubes have been synthesized using arc discharge and often exist in an randomly entangled state. Patterned and non-patterned carbon nanotube films having the nanotubes aligned perpendicularly with the substrate have been prepared by pyrolysis of iron (II) phthalocyanine in a flow reactor comprising a quartz glass tube heated by a dual furnace. Large arrays of well-aligned carbon nanotubes have been synthesized by radio-frequency sputter-coating of a thin nickel layer onto a substrate, followed by plasma-enhanced hot filament chemical vapour deposition of acetylene in the presence of ammonia gas at approximately 666 °C. See paragraph 0004.

Noca *et al.* teach a molecular sieve device comprising an ordered array of self-assembled nano-features which function as a molecular sieve to separate molecules

based on a suitable characteristic. See Abstract. The device in Noca *et al.* utilizes a non-gel ordered self-assembled array of nano-features that functions as an electrophoretic sieve to separate biomolecules. See Col. 4, lines 15-26. The self-assembled nano-array sieve comprises a substrate having a periodic array of features such that in the presence of an appropriate feedstock the atoms of the feedstock self-assemble on the ordered features of the substrate to produce an ordered array of nano-features having non-random alignment and size distribution. See Col. 4, lines 42-53.

Instant Claim 1 calls for a microfluidic sieve comprising a substrate having a microfluidic channel, an elastically compressed carbon nanotube mesh comprising a plurality of intertwined free-standing carbon nanotubes fixedly attached within and randomly extending from the surface of said channel to form irregularly sized mesh pores between the intertwined nanotubes for separating, concentrating, and/or filtering molecules flowed therethrough, and a cover layer sealably capping said microfluidic channel to thereby pack and elastically compress the carbon nanotube mesh in the microfluidic channel.

Instant Claim 45 calls for a method of separating, concentrating, and/or filtering molecules comprising the steps of flowing molecules through a microfluidic channel having an elastically compressed carbon nanotube mesh comprising a plurality of intertwined freestanding carbon nanotubes fixedly attached within and randomly extending from the surface of said channel to form irregularly sized mesh pores between the intertwined nanotubes, and a cover layer sealably capping said microfluidic channel to thereby pack and elastically compress the carbon nanotube mesh in the microfluidic channel, whereby said elastically compressed carbon nanotube mesh operates as an active medium for separating, concentrating, and/or filtering said molecules.

There is no suggestion or motivation, in either Dai *et al.* or Noca *et al.* or in the knowledge generally available to one of ordinary skill in the art, to combine the cited reference in the manner as suggested by the Examiner to arrive at the claimed invention. To the contrary, Noca *et al.* teach against combination with Dai *et al.* in the manner suggested by the Examiner. Noca *et al.* teach ordered array of self-assembled

nano-features throughout their disclosure. The emphasis of ordered array of self-assembled nano-features is conspicuously noticeable in Noca *et al.*'s Abstract, drawings, Claims, and Specification. While Noca *et al.* teach that the array can be staggered and the nano-feature can be cylindrical or in other shape or size or spacing at Col. 6, lines 17-53, Noca *et al.* emphasize throughout their disclosure that the array must be ordered and the nano-feature must be uniform. Upon reading of Noca *et al.*, one of ordinary skill would not have been motivated to replace the ordered array of uniform nano-feature with randomly entangled carbon nanotubes as picked by the Examiner from Dai *et al.*

Even if one of ordinary skill would have attempted to combine Dai *et al.* with Noca *et al.*, the combination would not arrive at the invention recited in instant Claim 1 or 45 because the purported combination does not teach or suggest each and every limitation recited in Claim 1 or 45. Instant Claim 1 or 45 calls for an elastically compressed carbon nanotube mesh comprising a plurality of intertwined free-standing carbon nanotubes and a cover layer sealably capping the microfluidic channel to thereby pack and elastically compress the carbon nanotube mesh in the microfluidic channel. Neither Dai *et al.* nor Noca *et al.* teach or suggest the limitation of elastically compressed carbon nanotube mesh or elastically compress. Thus the combination of Dai *et al.* with Noca *et al.* cannot arrive at the limitation of elastically compressed carbon nanotube mesh or elastically compress.

The Examiner argued that "there will be no compression only when the nanotubes are made to the exact heights to fill the channel up to the cover, which would not be random growth." The Examiner further argued that "the cover of the reference also would inherently elastically compress the nanotubes because the random grown nanotubes would at least some degree of over-growth, which would be compressed when covered." The Examiner's arguments were based on unsupported assumptions that Dai *et al.* and Noca *et al.* would have been combined in the manner suggested by the Examiner and that all randomly grown nanotube mesh would necessarily be outgrown from a channel structure and compressed to confine the mesh within the channel structure. Applicants respectfully submit that both assumptions are

unsupported and improper and thus the Examiner's arguments based on the assumptions do not hold.

In making the above unsupported assumptions, the Examiner relied upon the theory of inherency. However, the Examiner did not provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent "elastically compress" necessarily flows from the teaching of the cited references. It is well established that to establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. *In re Robertson*, 169 F.2d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999). Applicants respectfully submit the Examiner has not exclude the possibility that a randomly grown nanotube mesh can be enclosed in a relatively large structure and a cover layer may not even compress the mesh. The Examiner has not met the burden to show that the elastically compress limitation recited in instant Claim 1 or 45 is an inherent characteristic that necessarily flows from Dai *et al.* or Noca *et al.*

Based on the foregoing, Applicants respectfully request reconsideration of the rejection of Claims 1 and 45 under 35 U.S.C. 103(a).

Claims 3-15, 17-19, and 46 depend on Claims 1 and 45 respectively. Claims 3-15, 17-19, and 46 are therefore allowable for at least the same reasons as for Claims 1 and 45 and for reasons of additional limitations recited therein.

Applicants respectfully submit that the instant application is in condition for allowance. An early indication of the same is therefore respectfully requested. If any matters can be resolved by telephone, the Examiner is invited to call the undersigned attorney at the telephone number listed below. No fees beyond those being submitted concurrently herewith are believed due. However, the commissioner is authorized to charge any additional required fees, or credit any overpayment, to Foley & Lardner LLP Deposit Account No. 50-0872.

Respectfully submitted,

By



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